



INDEPENDENT COMPOST HOUSE AS A SUSTAINABLE URBAN ORGANIC WASTE MANAGEMENT MODEL

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Abstract

Neighborhoods or urban villages do not have facilities to dispose of or process tree-changing waste carried out by residents, which is prone to causing social, environmental health, and aesthetic problems. Independent composting houses expect a solution in the form of a mass composting program but on a scale still affordable at the RW or district level. One composting process unit with a volume of one cubic meter is capable of processing three trucks of intermediate waste—the introduction project conducted in RW 02 Kalirungkut, Surabaya City. Residents ask to collect the chaffing waste at a point, and after 1-2 months, thresh. The composting equipment consists of an iron frame with one cubic meter volume and a cubic meter composting bag. Following the threshing, the dry leaves were collected and placed in the bag along with an activated EM4 solution starter. After all the components add, the bag zips up, the content does not mix, and it places in the incubator for three months. After the incubation period, the material will change color to blackish brown, the structure will become crumbly, and the temperature will be the same as the surrounding air temperature as a sign that the compost is ready to be harvested. The harvested compost is put in small bags weighing 15-20 kg, ready to be distributed to residents or sold to the general public. Residents can use the compost to grow fruits, vegetables, or ornamental/garden plants. The spirit of the residents of RW 02 Kalirungkut Surabaya City continues to be encouraged to continue the independent compost house program by monitoring, assisting, and providing incentives, especially in the distribution of excess compost used by residents.

Keywords: Self-Sustaining Compost House; Tree Trimming Waste;

INTRODUCTION

Waste problems must be handled jointly by the government, non-governmental organizations, and the community. Therefore, it requires mutual awareness and commitment toward changing attitudes, behaviors, and ethics that are environmentally cultured. Community empowerment in managing waste provides provisions for managing waste into valuable products (Khasanah et al., 2020) and does not need to burden landfills (TPA) (Yustikarini et al., 2017). According to Koehuan, VA (2021), community empowerment programs in utilizing agricultural waste such as leaves, branches, and grass for making compost increase farmers' knowledge and skills in making organic fertilizers from abundant agricultural waste in the surrounding environment. Changing waste piled up in residential neighborhoods will cause problems for life and environmental health, especially people's lives—aesthetic (beauty) and comfort problems that are a nuisance to the eye. The accumulation of waste will become a nest for animals that disturb the peace, such as snakes, rats, and lizards, a source of the disease that will endanger public health, especially those who live close to the location of the waste

accumulation. In the rainy season, decomposing materials can produce leachate as the effect of the biological decomposition of waste has excellent potential in polluting surrounding water bodies, especially the groundwater below. In the dry season, dry waste will quickly fly around and easily catch fire.

Based on observations in the Surabaya City environment, compost houses or recycling centers are waste management and processing activities. Waste, especially household waste, is sorted into organic and inorganic. Organic waste is processed into compost or as a medium for BSF (black soldiers fly) propagation. Meanwhile, inorganic waste is recycled or put into collectors. Intermediate waste is separated, leaves and small branches composted, while wood and large branches use for electricity generation. The Department of Cleanliness and Green Open Space (DKRTH) controls the compost house or recycling center, so the operational costs are fully covered by the City of Surabaya. The chaining waste that enters the compost house is only limited to the chaining of urban forests/city parks/road shading plants carried out by DKRTH.

In Surabaya, the amount of biomass from chaining is considerable. Changing or cutting down old trees produces waste consisting of plant leaves, twigs, branches, and tree wood. So far, in Surabaya, the waste is managed by the Compost House or Recycling Center. Dry leaves and wood are used as raw materials to generate electricity (Haryanta D. et al. 2017; Haryanta D. et al. 2018). The Composting House and Recycling Center have only processed waste from the Department of Sanitation and wet waste from markets or households. The compost results primarily use to build parks and urban forests by the Surabaya City Cleanliness Office.

The community empowerment program aims to increase the community's ability to manage the potential of surrounding resources in preserving the environment as an ecological service and economic value (Jastam, 2015). One of the community empowerment goals is to process household waste into organic fertilizer that the community can use to improve welfare and create a clean environment (Hayat and Zayadi, 2018). Local governments must provide continuous assistance in community-based waste management (Aryenti and Darwati, 2012). The community will realize the importance of caring for the surrounding environment by understanding the importance of processing organic waste appropriately to create a clean and healthy environment (Juniartini, N.L.P. 2020).

The community partnership program "Rumah Kompos Mandiri" is carried out with the target of chaining waste carried out by the general public. With an urgent need, people often do chaining on trees in residential neighborhoods. Neighborhoods or urban villages do not have

facilities to dispose of or treat the churning waste. The existence of untreated churning waste will cause social, environmental health, and aesthetic problems. The activity aims to provide solutions for managing intermediate waste into compost on a business scale that can be carried out by the community independently. The community uses compost to grow ornamental plants, fruit plants (tambulapota), and vegetable plants.

COMMUNITY SERVICE METHOD

The method used in the implementation of the community partnership program (PKM) "Independent Compost House in RW 02 Kalirungkut Surabaya City" is the PRRA (Participatory Rapid Rural Appraisal) and RRA (Rapid and Rural Appraisal) method starting from the preparation of activity planning, organizing, implementing and monitoring and evaluating the target group.

Namely, the RW 02 Kalirungkut community and involving the companion, namely the Field Extension Officer (PPL) of the Surabaya City Food Security and Agriculture Office, as well as from universities which include lecturers and students, are involved synergistically. The method expects to foster a greater sense of belonging from the target community so that the goal of building an independent compost house in RW 02 Kalirungkut Village, Rungkut Subdistrict, Surabaya City achieve, is functional and sustainable.

Overview of Technology in Compost House Building

The activity of building an independent compost house, especially the process of processing organic waste into compost, refers to the Appropriate Technology of Haryanta et al. (2021). The construction of an independent compost house carry out four activities: preparing materials and equipment, carrying out the composting process, harvesting compost with practical bags or packs for distribution or sale, and applying compost use for farming.

1. Preparation of Materials and Tools

The material that will process into compost is the churning waste carried out by residents, piled up for 2-3 months so that the leaves wither to dry quickly for threshing. Materials to accelerate the fermentation process using EM4 solution as a starter, containing microbes that decompose organic materials into inorganic materials. The decomposing microbes in EM4 active before use by mixing 500 cc of EM4 solution, 500 grams of sugar, and 4500 cc of water, then the mixture is put in a jerry can and tightly closed, incubated for 3-5 days and then can be used in the composting process. The tools used include a framework of iron with a diameter of 10-12 mm in the form of a cube with a side size of 1 meter, so the volume of

the framework is one cubic meter. Composting bags are made of polyethylene (glassing) in the shape of a cube with a side length of 1 m so that the bag's volume is one cubic meter, with a lid on the top the composting bag mounts on a metal frame and ties at the corners. The lid opens, and the intermediate waste puts in the bag composting process an overview of the metal frame and composting bags is present in Figure 2.



Figure 1 Pile of tree-trimming waste



Figure 2 Iron frame and composting bags

2. Composting Process

The composting process begins with putting the threshed chaffing waste into the bag. Every layer of material approximately 15 cm high in a compacted position is sprayed with starter solution (activated EM4) until it is flat, and so on until the composting bag is full in stable conditions; the denser the composting process will be, the more effective. The process of putting the waste material into the composting bag shows in Figure 3, and the filled bag shows in Figure 4. The complete composting bag seal ties as tightly as possible, then the iron frame is removed for the next composting unit. At the same time, the filled and tied bag incubators for 90 days without stirring opened every week when they looked dry, surfaced by watering with water, and sprayed with EM4 solution every month. The composting process chooses a place protected from direct sunlight and not waterlogged. The composting process will be effective if moisture is maintained.



Figure 3

Putting the intermediate waste into the composting bag and adding with EM4 starter solution



Figure 4

The composting bag is complete and ready to be closed.

3. Compost Harvesting Process

Changing waste material has become compost when it has shown the characteristics of the color have changed to blackish brown, and the structure is crumbling quickly. The temperature is the same as the surrounding air temperature, and if possible, test the C/N ratio value below 20. The appearance of the composted chaining waste material after passing the incubation period for 90 days is ready to be harvested, as shown in Figure 5. Harvesting does by unloading the material from the bag while stirring. The accompanying materials in the form of twigs, plastic, or other inorganic material separate. The compost material puts in small bags weighing 15-20 kg, as shown in Figure 6. which are ready to be distributed to consumers.



Figure 5

Appearance of composted leaves after 90



Figure 6

Compost packaging that is ready to be

days of incubation

distributed to residents or consumers

4. Overview of crop cultivation with compost

The compost can use for fruit crop cultivation, including longan plants planted on the berem road, as shown in Figure 7, for cultivating tomatoes in polybags, as shown in Figure 8, and for cultivating melons plants in polybags, as shown in Figure 9.



Figure 7. Compost for planting longan on berem road



Figure 7

Compost for growing tomatoes in polybags



Figure 8

Compost used to grow melons in polybags.

Stages of Community Service

The stages of implementing appropriate technology are as follows:

- a. Socialization of the appropriate technology implementation program to the community, providing an overview of the value of benefits obtained by the community after implementing the program.
- b. Coordination with the relevant parties, particularly the PPLs, who assist the community in Kalirungkut Village.
- c. Develop technical programs and activity schedules with the community;
- d. Prepare equipment and materials used in the implementation of the program, namely iron frames and bags for composting, as shown in Figure 1,
- e. Make a starter as supporting material in the composting process;
- f. Carry out the composting process while waiting for the organic waste to be collected every day (it can't be a lot right away)
- g. Perform the composting process
- h. The harvested compost puts into bags weighing 15-20 kg to be distributed to residents in need or sold to the general public.
- i. They are planting seedlings to utilize compost for *urban farming* activities.
- j. Harvest compost, packaged into products ready for sale;
- k. Monitoring and Evaluation of activities by making progress reports in the middle of activities.
- l. Compile activity outputs, namely publication manuscripts in national journals, activity reports, and other required documentation.
- m. Preparing program accountability and preparing the final report of activities

RESULTS AND DISCUSSION

1. Socialization/Counseling on the Establishment of Independent Compost House

Building an independent compost house must be understood by the community as a solution to the problems faced, namely the difficulty of disposing of tree trimming waste which has caused social and environmental problems. The independent compost house is a program that emerges from the community as a solution to the problem carried out through active participation of the community, and the results return to enjoy by the community. Tree trimming waste in the form of twigs and leaves is collected and piles up until they are sufficient for a composting processing unit. Experience has shown that it takes 2-3 truckloads of chipping waste to process one composting unit. Piles with 1-2 months of dried leaves are easy to thresh and separate from twigs and branches. The leaves and small branches then process into compost. The socialization of the independent compost house

program in RW 02 Kalirungkut at RW 02 Hall attending by 26 residents, especially RW and RT administrators and residents interested in farming activities. The socialization materials included appropriate technology for processing waste into compost, techniques for using compost for fruit cultivation, planting longan fruit, and the possibility of developing a business unit by selling excess compost products to the general public.



Figure 9

Socialization of Changing Waste
Composting Techniques



Figure 10

Socialization of compost product
management development

2. Handover of Equipment/Material Inventory

The realization of an independent compost house requires equipment that has yet to be available in the market and is generally not known to the community. A composting bag of solid and durable polyethylene material (from the experience of three years of use, it is still strong) in the shape of a cube measuring one cubic meter also encourage residents of RW 02 to realize their own compost house.

The equipment in the form of an iron frame, composting bags, shredding tools for plant waste that is difficult to disintegrate, EM4 solution as a starter, and small bags to accommodate compost results are facilitated or provided by the grant program. In utilizing compost for farming, residents give new crystal longan seeds suitable for lowlands such as Surabaya, which are two years old and ready to bear fruit in the second year.

Which expected to be a driving factor in building the RW 02 environment into a green and productive environment, and the implementation of activities is assisted, starting from preparing compost raw materials, composting process, harvesting compost, planting longan seedlings, and maintaining longan plants. The signing of the equipment and material

inventory handover minutes is presented in Figure 11, while the physical inventory handover can see in Figure 12.



Figure 11

Signing the Minutes of Inventory
Handover to the Head of RW 02
Kalirungkut



Figure 12

Physical Inventory Handover to the Head of
RW 02 Kalirungkut

3. Composting Practice

The socialization material, especially related to the composting process, was practiced together between community members and students with experience carrying out the composting process. The process begins with starter activation, namely making a mixture of EM4 liquid, sugar, and water stirred until evenly distributed and then put in a jerry can, incubating for 3-5 days, and then using. The threshed chaffing waste is put into the composting bag while compacting, as shown in Figure 14. Each layer with a thickness of about 15 cm is compacted and given a starter solution until it evenly distributes, as shown in Figure 15, then given dry leaf material for the next layer and carried out until the composting bag is complete in a stable condition. Next, the bag is tightly closed, tightly tied, and incubated for 90 days. In this activity, it is only until the filling of waste into the bag that the compost harvest period has yet to arrive.



Figure 13

Putting the Intermediate waste into the
Composting Bag



Figure 14

Application of Starter Solution to the
Intermediate Waste Layer

4. Planting longan plants

Planting longan seedlings is a form of introducing procedures for utilizing compost from tree trimming waste for urban farming. The compost harvest is from a similar activity conducted by students of the Faculty of Agriculture, Wijaya Kusuma University Surabaya in Jambangan Village. The planting medium for longan makes by mixing compost with garden soil in the same ratio (1:1).

Longan seedlings are 2-3 years old, so their roots are already numerous and strong enough. Improper planting methods cause the soil in the root area to break up, and many roots break off, and there is a risk that the seedlings will experience stress or even die after planting. Planting on land requires preparing a planting hole measuring 60 x 60 cm with a depth of 75-60 cm. The seedling inserts into the hole, and the ropes bind the rooting soil to remove it. When the soil has begun to crack, the hole can fill with planting media, a mixture of urban waste compost, and garden soil in the same ratio (1:1), and then the ropes pull. The mixture of compost and garden soil using to fill the planting hole, seedling wall the hole, and buried on top. After the planting is complete, the seedling gives the water on top of the soil. The position of the seedlings in the planting holes showing in Figure 16, and the final condition seedlings can see in Figure 17. The first monitoring was carried out one week after planting while explaining how to care for the plants, as shown in Figure 18.



Figure 15

Planting process of longan seedlings



Figure 16

Use of Compost from Intermediate Waste
for Planting longan



Figure 17 Explanation of longan plant maintenance

The train of thought for making compost houses independently in RW 02 Kalirungkut Surabaya City is the development of community empowerment experiences in urban organic waste management to support urban farming practices. Community assistance in managing waste, especially household organic waste, and utilizing it to support urban farming activities will optimize the potential of the community into productive and economically valuable activities (Amaranti et al., 2016). According to Asier and Saad (2016), the community group-based organic waste management model produces compost that can be used independently and becomes a model of independent waste management. The community empowerment program

utilizes agricultural waste such as leaves, wood branches, and grass with 30% forage and 60% brown materials.

As well as ten percent of the other components for making compost fertilizer, this has increased farmers' knowledge and skills. It recognizes as a solution to the problem of sizeable agricultural waste in the surrounding environment (Koehuan et al., 2021). The farmer group, "Satu Padu" of Jambangan Surabaya Village, has implemented a program to process urban organic waste into compost and liquid organic fertilizer (POC), the results of which use for the cultivation of melon, cauliflower, tomato, and chili plants (Haryanta et al., 2022). According to Khasanah et al. (2020), after the community is skilled in processing waste into compost, it is necessary to train residents to market the products produced to add economic value to the compost processing process until done. The existence of an independent compost house in the RW environment will support the *green community* program, which directly supports the Surabaya city *green city* program (Kusuma et al., 2020). The practice of processing waste into *urban farming* media increases independence in providing daily food sources, especially the provision of vegetables to meet daily food needs (Yuliana et al., 2020). Assistance activities in household waste management have changed people's behavior regarding waste disposal and impacted the use of organic waste in *urban farming* activities (Dewi and Nugraha, 2022). According to Teruna et al. (2018), counseling on composting from organic waste has a positive contribution to increasing the yield of residents' gardens which are harvested quickly with good results and processing waste efficiently without burning waste. Using leaf waste to make compost is an intelligent, creative solution because it has many benefits. It can foster an entrepreneurial spirit in the community (Setyaningsih et al., 2017).

CONCLUSIONS

The community partnership program (PKM) Independent Compost House in RW 02 Kalirungkut Surabaya City is a collaborative program between the Directorate of Research, Technology, and Community Service (DRTPM) and Wijaya Kusuma University Surabaya. The activity publishes on *online* media with the link: <https://surabaya.tribunnews.com/2022/08/07/dosen-uwks-help-address-waste-tree-twigs-by-establishing-compost-houses>; <https://beritalima.com/pengabdian-uwks-pada-masya-rakat-ubah-masalah-jadi-produktif/> and the activity video upload on LPPM UWKS youtube with the link: <https://www.youtube.com/watch?v=jmMqcKD9hUA>.

The independent compost house for residents of RW 02 Kalirungkut is a solution to the residents' problems in disposing of tree-trimming waste, which has only piled up, potentially causing social and environmental insecurity. The compost produced opens up opportunities for residents to develop the cultivation of fruit plants, vegetable plants, and ornamental plants. The spirit of the residents in following up on the program continues to be encouraged by continuing to monitor, assist, and provide incentives, especially in the distribution of excess compost used by residents. The management of RW 02 Kalirungkut will soon follow up on the formation of a compost management unit as well as foster an entrepreneurial spirit in the community.

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